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US006349722B1

(12) **United States Patent**
Gradon et al.(10) **Patent No.:** **US 6,349,722 B1**
(45) **Date of Patent:** **Feb. 26, 2002**(54) **RESPIRATORY HUMIDIFICATION SYSTEM**(75) **Inventors:** Lewis George Gradon; Stephen William McPhee; Paul John Seakins; Peter John Leonard, all of Auckland (NZ)(73) **Assignee:** Fisher & Paykel Limited, Auckland (NZ)(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.(21) **Appl. No.:** 09/097,832(22) **Filed:** Jun. 16, 1998(30) **Foreign Application Priority Data**Jun. 17, 1997 (NZ) 328116
Apr. 27, 1998 (NZ) 330295(51) **Int. Cl.⁷** A61M 15/00; A61M 16/00; H05B 3/00(52) **U.S. Cl.** 128/203.17; 128/204.17; 261/129; 261/131; 261/142; 261/DIG. 65; 236/44 A; 236/44 R; 165/295(58) **Field of Search** 128/203.12, 203.16, 128/203.17, 203.26, 204.17, 204.22; 261/129, 130, 131, 142, DIG. 65; 219/490, 494; 165/222, 223, 229, 230, 253, 281, 287-290, 295; 236/44 R, 20 E, 912, DIG. 13; 392/460-466(56) **References Cited****U.S. PATENT DOCUMENTS**2,084,514 A * 6/1937 Tuttle et al. 261/142
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A flow probe for use in a humidification system is disclosed. The flow probe is adapted to be positioned in a humidified gases flow (for example oxygen or anaesthetic gases) such as that which is provided to a patient in a hospital environment. The flow probe is designed to provide both temperature and flow rate sensing of the gases flow by incorporating two sensors (preferably thermistors) and the shape and alignment of the probe enables accurate readings by reducing the occurrence of condensation on the sensors. A number of possible applications are disclosed wherein the flow sensor is, included in humidification control systems which provide a patient with a desired humidity level or simplify the amount of user input required or wherein the flow sensor provides a controller with flow information which may then be used to determine certain, possibly dangerous, conditions (such as incorrect flow sensor placement, breathing circuit disconnected, no water in the humidification chamber or humidity out of required limits).

27 Claims, 6 Drawing Sheets